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Title: Ultimate Strength and Optimization of Aluminum Extrusions

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Abstract: Recent large aluminum high-speed vessels have made use of custom extrusions to efficiently construct large flat structures including internal decks, wet decks, and side shell components. In this paper an efficient method for designing and optimizing such extrusions to minimize structural weight is presented. Strength methods for extrusions under in-plane and out-of-plane loads are briefly reviewed and shortcomings in existing aluminum strength prediction methods for marine design are discussed. A multi-objective optimizer using a genetic algorithm approach is presented; this optimizer was designed to quickly generate Pareto frontiers linking designs of minimum weight for a wide range of strength levels. The method was used to develop strength vs. weight Pareto frontiers for extruded panels for a main vehicle deck and a strength deck location on a nominal high-speed vessel.

Keywords: aluminum, ultimate strength, optimization, extrusion, genetic algorithm